HISTORY AND PRODUCTION OF ENGINEERING AND RESEARCH CORPORATION

By

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SUMMARY

The history of this young company, The Engineering Research Corporation, is more or less limited. This is due not only to the short span of its existence, but also to the fact that its growth - while very rapid - was not deliberate but merely following in the footsteps of its own progress. The company has grown from a concern housed in a small building employing eight men to an important corporation in the avaition industry. It is now located in a modern structure and gives employment to approximately two hundred people.

At present the Engineering Research Corporation is interested in three phases of production; namely- Machinery for forming airplane structures, Propeller design and manufacture, and Marketing their own exclusive airplane, the ERCOUPE. It is with this latter product that they hope to make the country airminded. This will be affected by putting the airplane on the same level as the automobile with regard to cost, safety, and ease of operation. The machinery they produce is sold to many of the large airplane manufacturing companies which shows well enough the progress in this field. Information on propeller production has been well guarded because of government contracts but it is reasonable to assume that advancement is being made otherwise these contracts would be cancelled.

After investigating all these achievements it is easy to see that the corporation is not static but moving forward continually. This forward movement is resulting not only in their own financial success but also in the advancement of the avaition industry as a whole.

HISTORY AND PRODUCTION OF ENGINEERING RESEARCH CORPORATION

The Engineering Research Corporation Of America was first conceived by Henry A. Berliner of Washington. Under his leadership and promotion the charter was obtained and the company was incorporated in 1930. Mr. Berliner was named president at that time; a position which he has held ever since.

The prime purpose for the organization of the company was to carry out experiments in the interest of the Avaition industry both with respect to airplanes themselves and machines for their construction, with the hope that some inventions would be developed along these lines. Having this in mind, the President of the Corporation brought eight men from the B J Aircraft Company in Baltimore to work for him at the plant, which consisted of a small shop located in Washington,D. C. At this small shop many experiments were carried on with a two place light flying boat which they had constructed. Some work was also performed on machinery for shaping sheet metal.

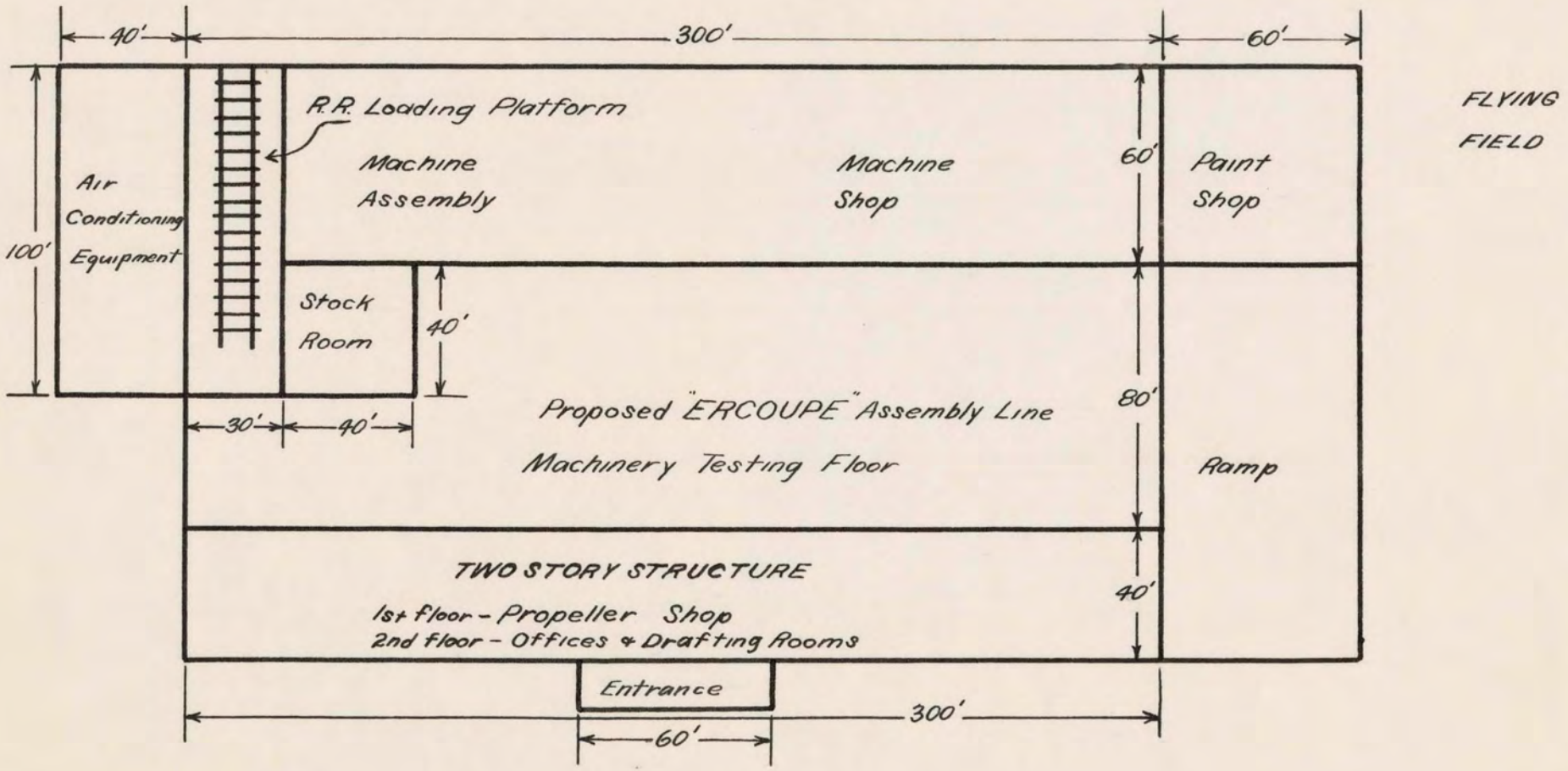
Work of this mature was elaborated on for four years but at no time did the number of employees exceed fifteen. In 1934 the Company was moved to 6100 Sligo Millroad in Washington. Here the factory consisted of a much larger building with an increase in the number of employees to approximately one hundred. Work was continued on machinery for making airplane parts with the principal emphasis upon those for making propellers, shaping sheet metal and riveting, A four place low wing

monoplane was constructed and its characteristics determined.

In November 1938 The Engineering Research Corporation was moved to Riverdale, Maryland. It is here that the factory is now located. The principal reason for the relocation of the plant in the Washington suburb was to secure enough level ground for an airport ajacent to the factory. This spot was one of the few tracts of land available while the convenience of transportation facilities of the Baltimore and Ohio Railroad made it very desireable.

The present structure which now houses the factory is a modern building built of brick and steel. It is completely Air Conditioned with large sheet metal ducts supplying warm air in the winter and cool air in the summer. The air is automatically controlled at all times with regard to moisture content; this being necessary because of the characteristics of materials used in the manufacture of propellers and airplane structures. The front of the building is a two story structure with drafting rooms and offices upstairs. The rest of the plant is only of one story construction with sky lights in the roof and walls of glass brick admitting plenty of light, so that in daytime none of the plant needs much artificial illumination.

The plant itself is layed out in seven different principle parts namely; Offices, Propeller Shop, Paint Shop, Machine Shop, Machine Assembly, Stock Room and Heating Plant. This is shown in Figure 1 .



FLOOR PLAN OF ENGINEERING RESEARCH CORPORATION AT RIVERDALE, MD.

Figure 3

The original intent of this corporation was to carry on experiments to develop new principles and inventions for airplane manufacturing machinery, have them patented and then sell the patent rights to some other company. This meant doing none of the producing themselves, leaving that up to the new concern.

The original intention of the company could not be carried out however because during the depression, when money for new adventures was not so plentiful, no one was interested in such inventions as were developed; therefore the policy had to be changed. The new one adopted was that of developing inventions for airplane manufacturing equipment, making the equipment and then selling the finished machinery to other companies. It is this policy upon which the company now operates.

It should be noted here that the trade name of this company is ERCO which comes very naturally from Engineering Research COrporation. At present the machines manufactured by ERCO are-- Automatic Punching and Riveting Machines; Propeller Profiler; Hydraulic Stretching Press; Sheet Metal Shrinker; and Sheet Metal Former. Besides this machinery which is produced the company has another product, one which has received more publicity than all the rest put together--namely the small airplane trade named ERCOUPE. A more detailed explanation of some of these products will now be given.

ERCOUPE

This small light weight airplane (Figure 2) is the result of many years of research and planning till today the product, which shortly will be turned out for retail delivery, is just as its trade slogan says, "No Stall-No Spin-Safety Built In." It is guaranteed spinproof as a result of many test flights by stunt fliers whose attempt to do so were of no avail.

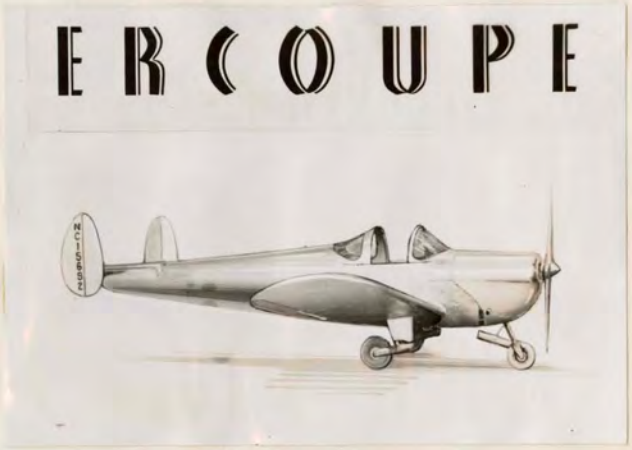
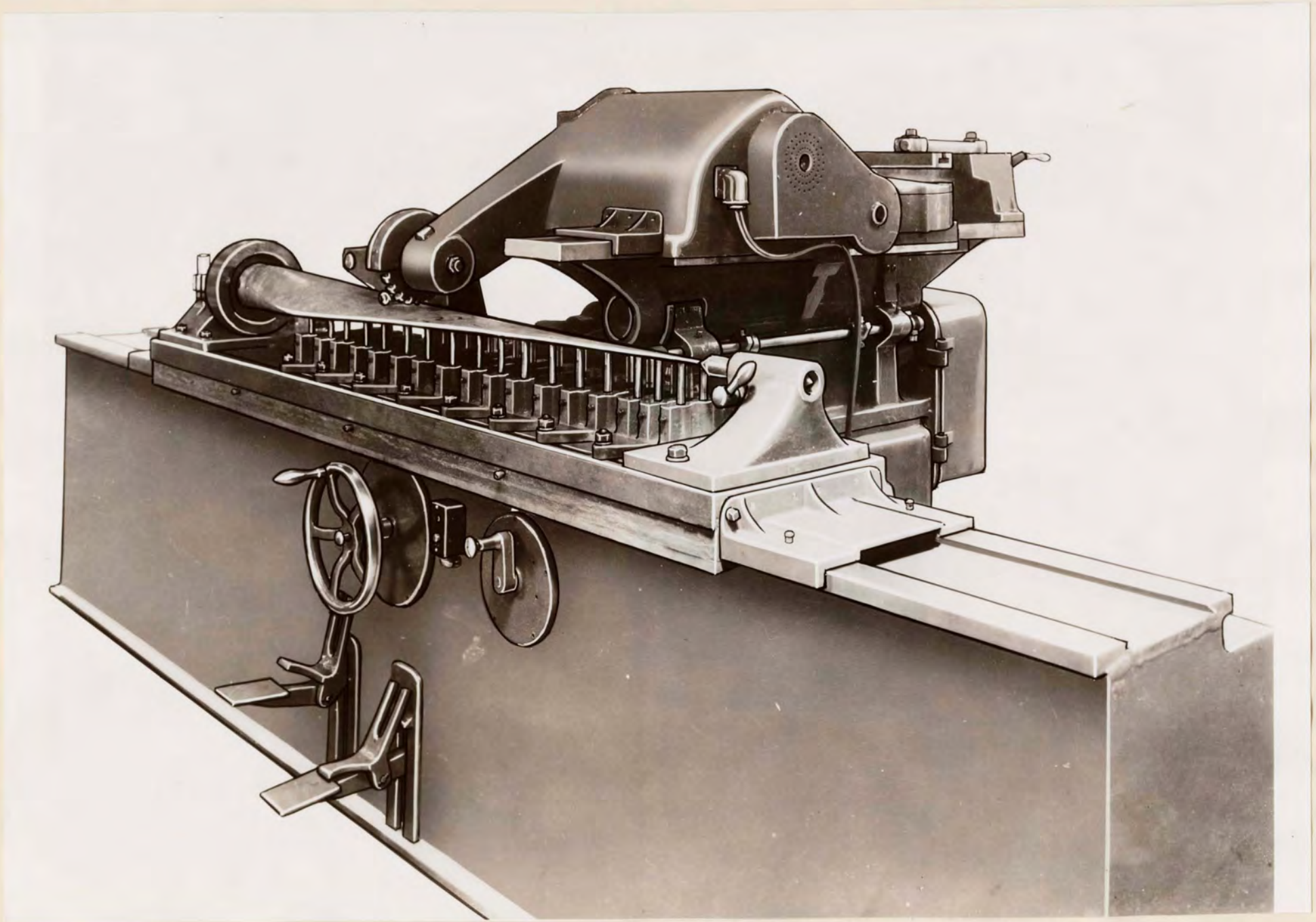


Figure 2

The quick take-off, rapid climb, and high sustained cruising speed of the ERCOUPE provide point to point transportation which will surprise and please the private pilot. The ability to land easily at any speed between 35 and 80 m.p.h., to stop in an astounding short run, and to operate safely under adverse weather conditions eliminates that anxiety and uncertainty of weather commonly associated with light planes.

Simplicity in flying has been achieved by elimination of the rudder pedals--the airplane being flown entirely by the control



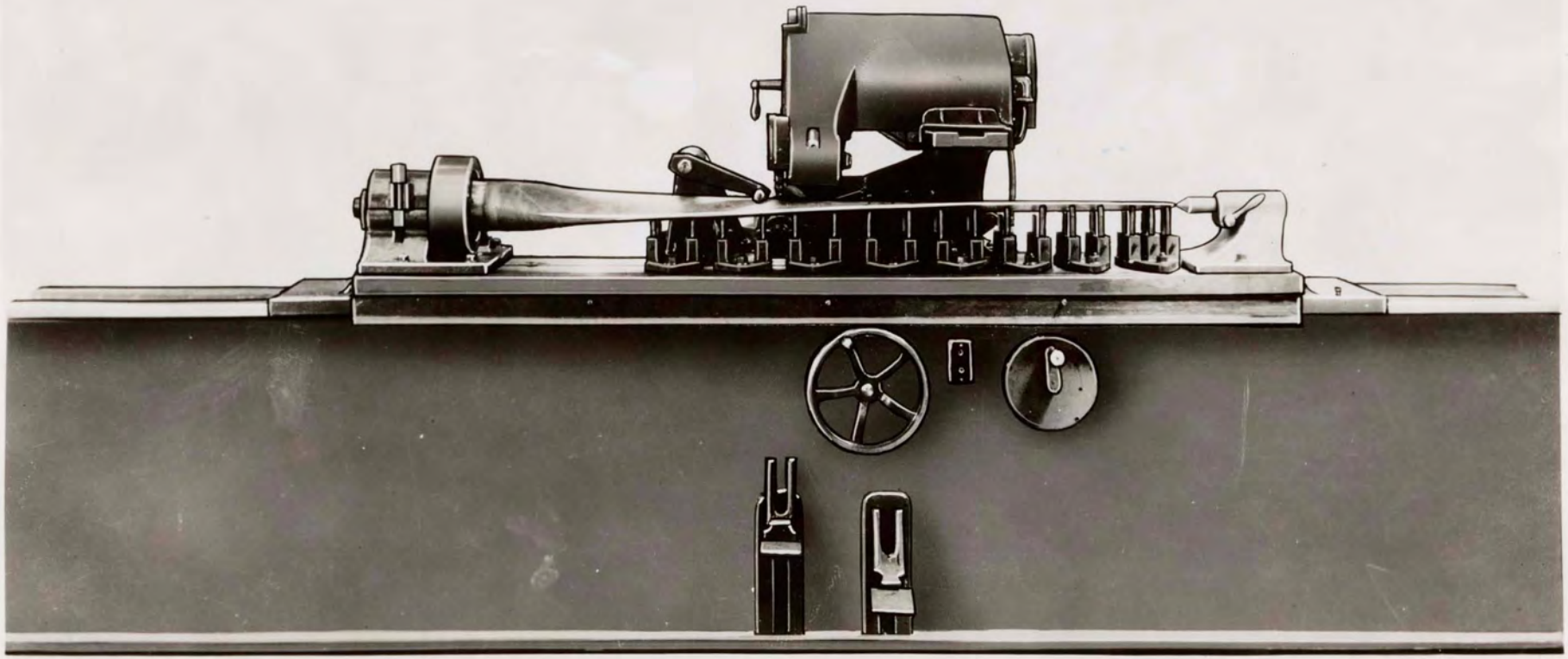
END VIEW OF PROPELLER PROFILER

wheel. Ailerons, rudder, and nose wheel are all mechanically coordinated so that turning is accomplished in the air, asit is on the ground, by turing the wheel to the right or left--the proper bank is always maintained in turns at any speed.

The ERCOUPE has amazing stability--it will not get "out of control"--even with the wheel full bach straight flight can be maintained or turns performed at will. On the ground, as in the air, the ERCOUPE will handle with ease. No nose-over is possible even with full application of the hydraulic brakes, powerful enough to skid the tires. No ground loop will occur even on crosswind landings or high speed turns, nor balloning-off even when landing at high speeds or in strong gust winds.

The structure of the plane is all metal, as is the covering structure of all but the outer wing panels. The cabin seats two comfortably, side by side, and permits closing by two sliding curved panels meeting at the top. Controls are operated by push rods or straight cables, pulleys having been eliminated to avoid friction and possibility of jamming. The landing gear is of tricycle design.

This plane was designed by Mr. Fred E. Weick, chief engineer of the corporation, and constructed under his personal supervision. At present only two of these ships are completed, but it is the intention of the officials of the company to turn them out in lots of ten and sell them at retail to the public. In fact the present layout of the plant is being rearranged so that an assembly line may be formed for mass production.



FRONT VIEW OF PROPELLER PROFILER

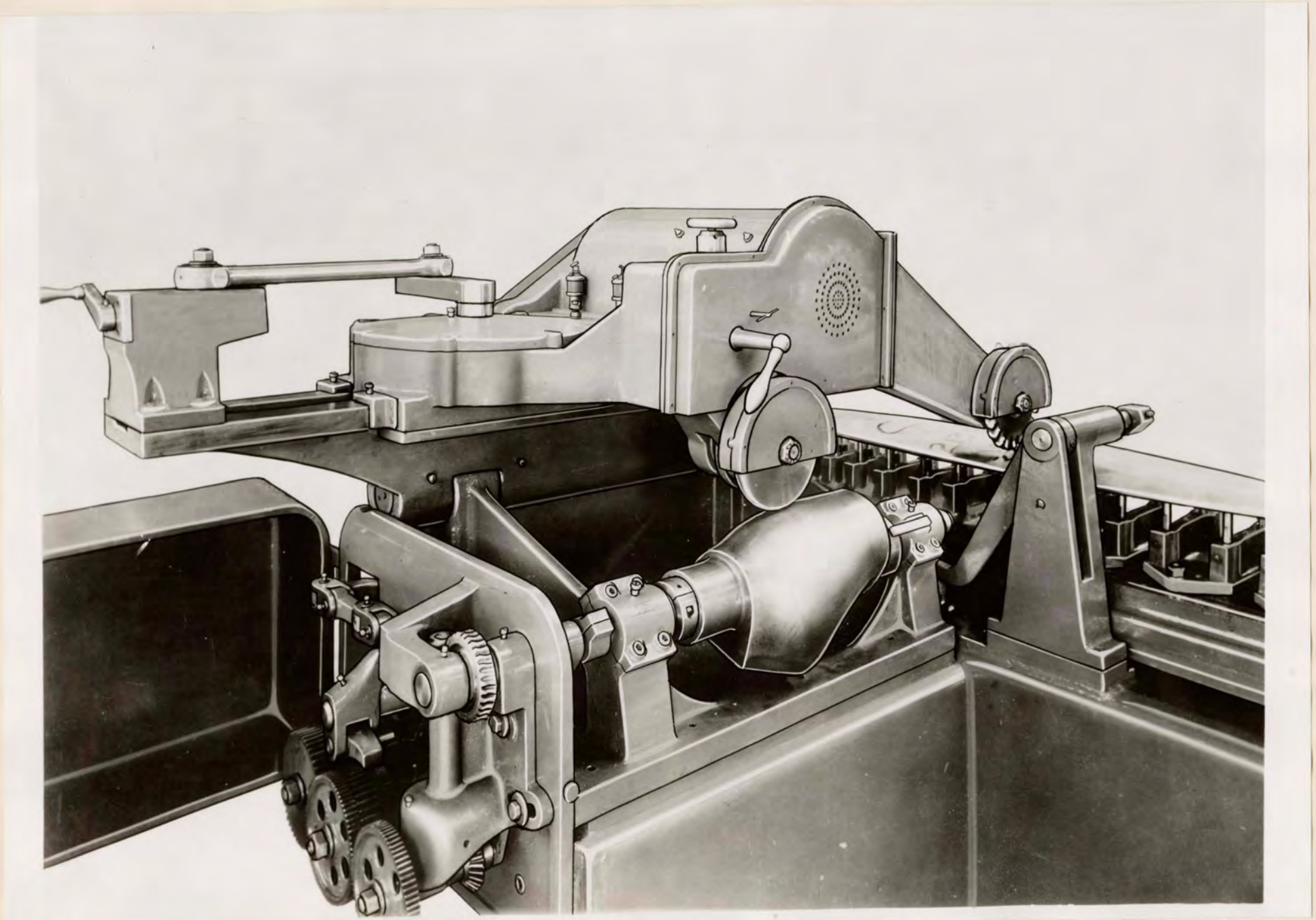
PROPELLER PRODUCTION

Not much information of ERCO work upon propellers could be obtained because they are collaborating with government engineers both in design and production. Due to unsettled world-wide conditions these processes are being kept secret. A brief summary however will be given on a propeller-making machine which they sell to the public. It is known as PROPELLER PROFILER.

This machine is the result of four years research and development by the corporation. The experimental model was completed last year and thoroughly tested by the Hamilton Standard Propeller Company of East Hartford, Connecticut. After several month's trial, during which time they checked the accuracy, speed and practicability of the machine they collaborated with ERCO in the redesign and offered many valuable suggestions which have been incorporated in the newest model.

Credit for the original conception of this machine goes to Mr. James Lee Simmins whose propeller experience dates back to 1910 when he produced the wooden propellers used on many of the more successful American airplanes of that era.

In 1930 Mr. Henry A. Berliner after investigating Mr. Simmin's design and hearing his suggestions as to the possible improvements that could be made, entered into an agreement with Mr. Simmins whereby the Engineering and Research Corporation undertook to produce a machine capable of producing metal blades. The first machine was built and after some modification was

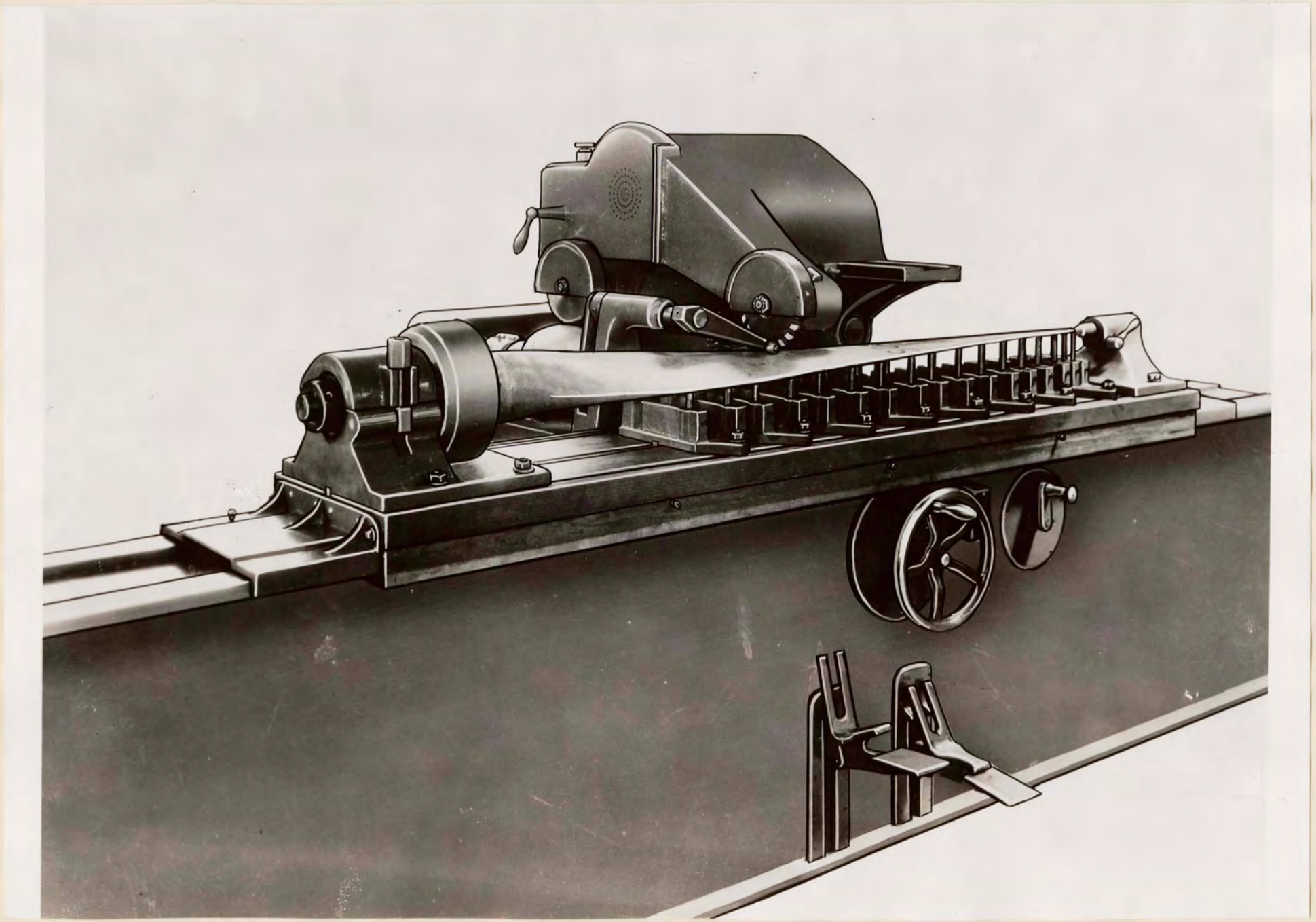


VIEW OF PROPELLER PROFILER SHOWING MASTER CAM

found to be capable of producing metal blades on a commercial scale with far greater accuracy than had ever before been achieved.

Operation of Profiler: Contrary to the "copying lathe" principle employed by most machines the present design profiles one side of the blade at a time. The master cam or form is a solid piece of cast iron whose length is about two inches more than the maximum width of the blade being produced. The cam rotates and is directly geared and syncronized with the table holding the blade forging which is ged horizontally past the cutter. Thus each line radially on the master cam or form represents a corresponding element of the blade. The cutter with the roller of similar profile reciprocates fore and aft in simple harmonic motion and oscillates freely about a trunion which permits the vertical travel necessary to the contour. The blade is fed horizontally past the cutter from tip to hub. at about the eighteen inch station (measured from the hub) the cutter lifts off the forging and the machine is automatically shut off. The table is then cranked back to the starting position by means of a hand wheel, a new forging is inserted, and the machine is then started by means of a conveniently located push button switch.

The propeller is supported on the table by a head and tail stock. The tail stock connection permits horizontal expansion. Between the head and tail stocks are closely spaced and easily adjutable steady rests.



VIEW OF PROPELLER PROFILER SHOWING WORK OF ROLLER

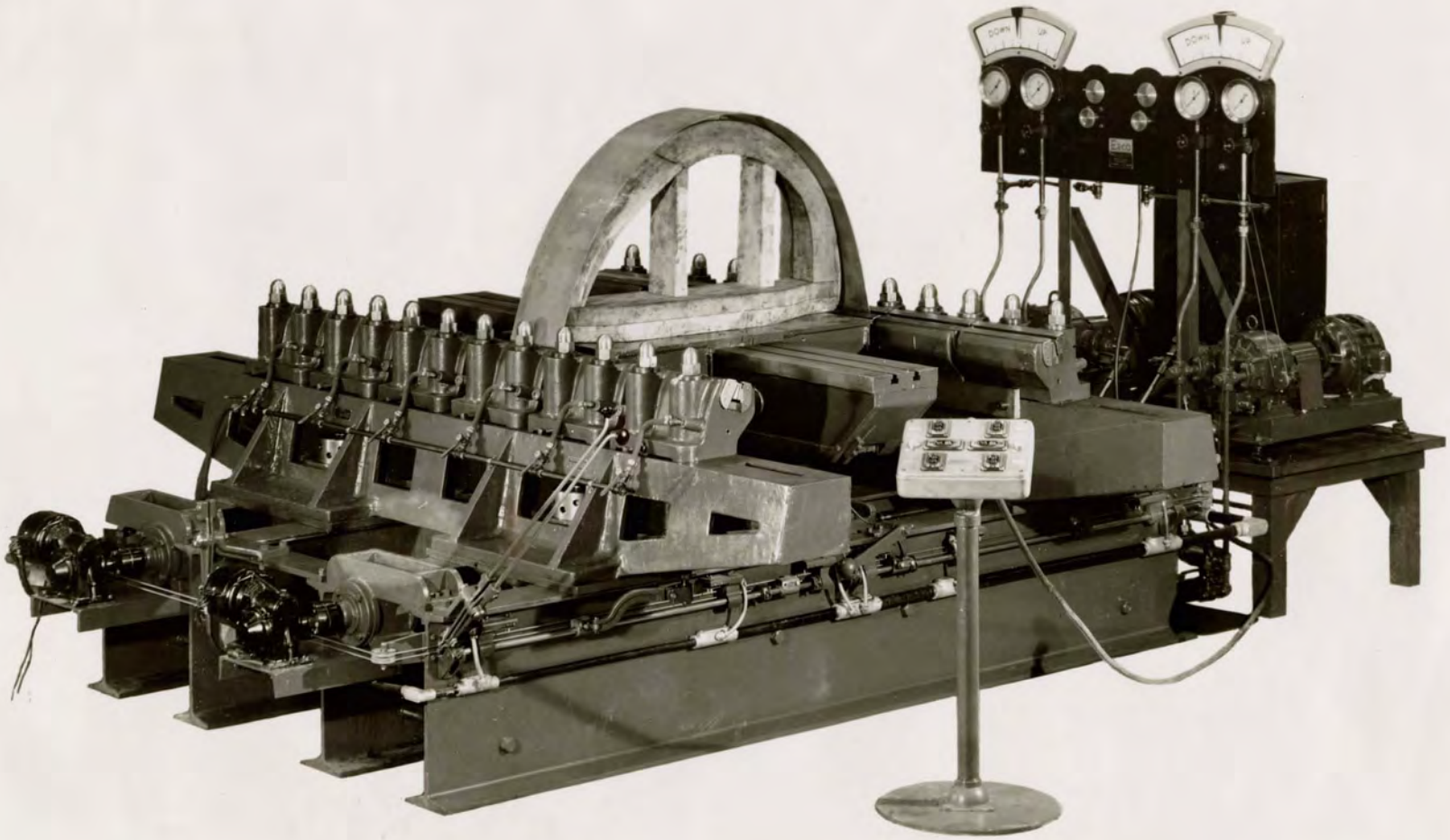
The blade is held tightly against these rests by means of a weighted roller, located just ahead of the cutter to insure contact at the point being machined.

To produce the master cam of form, the cutter and roller are reversed on the machine. A master blade (which has been carefully finished by hand) is placed in position on the table and wooden fairing is worked around it so that the roller can travel about one inch past the leading and trailing edges of the master blade. A wooden block is placed on the master cam shaft and this is then cut to the desired form by the machine, an allowance for shrinkage being made. An iron casting is made this wooden pattern which is placed on the machine and then ground from the master blade in the same manner that the wooden pattern was cut.

About one hundred and fifty hours are now required to produce a pair of master cams although it is believed that this may be considerably reduced, particularly when several sets are being made at once. Of course only a portion of this is done on the profiler, the remainder being lathe and pattern work.

ERCO HYDRAULIC STRETCHING PRESS

This press is a two cylinder hydraulic press designed to form sheet metal by restraining two edges of the sheet to be formed with clamps and forcing a wooden or metal male die upward into the work. (see photograph) The use of this machine eliminates the necessity of a female die. This results in a saving of both time and money on any particular job.



HYDRAULIC STRETCHING PRESS

SHEET METAL SHRINKER

The Sheet Metal Shrinker, sometimes called an "Upsetter", was developed in response to the demand of the aircraft industry for a method of forming and fitting various sheet metal parts. A machine was required to reduce the length of a piece of metal in a localized area, which action is just the reverse of that obtained with hand or power hammers.

The Shrinker in its refined form is able to perform this operation efficiently on various metals including mild and stainless steels, as well as the aluminum alloys for which it was originally designed, and therefore should find its way into all industries which work sheet metal for various uses.

The heart of the shrinker is the jaw system which can be seen in Figure 3. Two pairs of identical jaws are used. The upper ones are mounted on an anvil attached to a reciprocating ram that moves vertically, while the lower ones are on a similiar anvil attached to a tool post. The jaws themselves are wedge shaped pieces of tool steel resting on inclined surfaces of the anvils and held apart against pins in the anvils by coil springs within them. Their working surfaces, which are roughened to aid in holding the work, are parallel to one another, and grip the metal to be shrunk at two points at the same time. The stroke of the ram is so adjusted that it travels beyond the point where the work is gripped and in so doing it forces the jaws to slide down the inclined surfaces of their anvils, compressing the coil springs and the work at the same time. The springs, of course, are not permanently affected

by this action, but the metal between the two areas gripped by the jaws is compressed beyond its elastic limit and is thereby reduced in length and increased in thickness. By feeding sheet metal through the machine an operator can in this manner produce double curvature shapes, remove wrinkles in previously formed pieces, or perform any of several related operations almost impossible with the other metal working tools.

JAW SYSTEM OF SHEET METAL SHRINKER

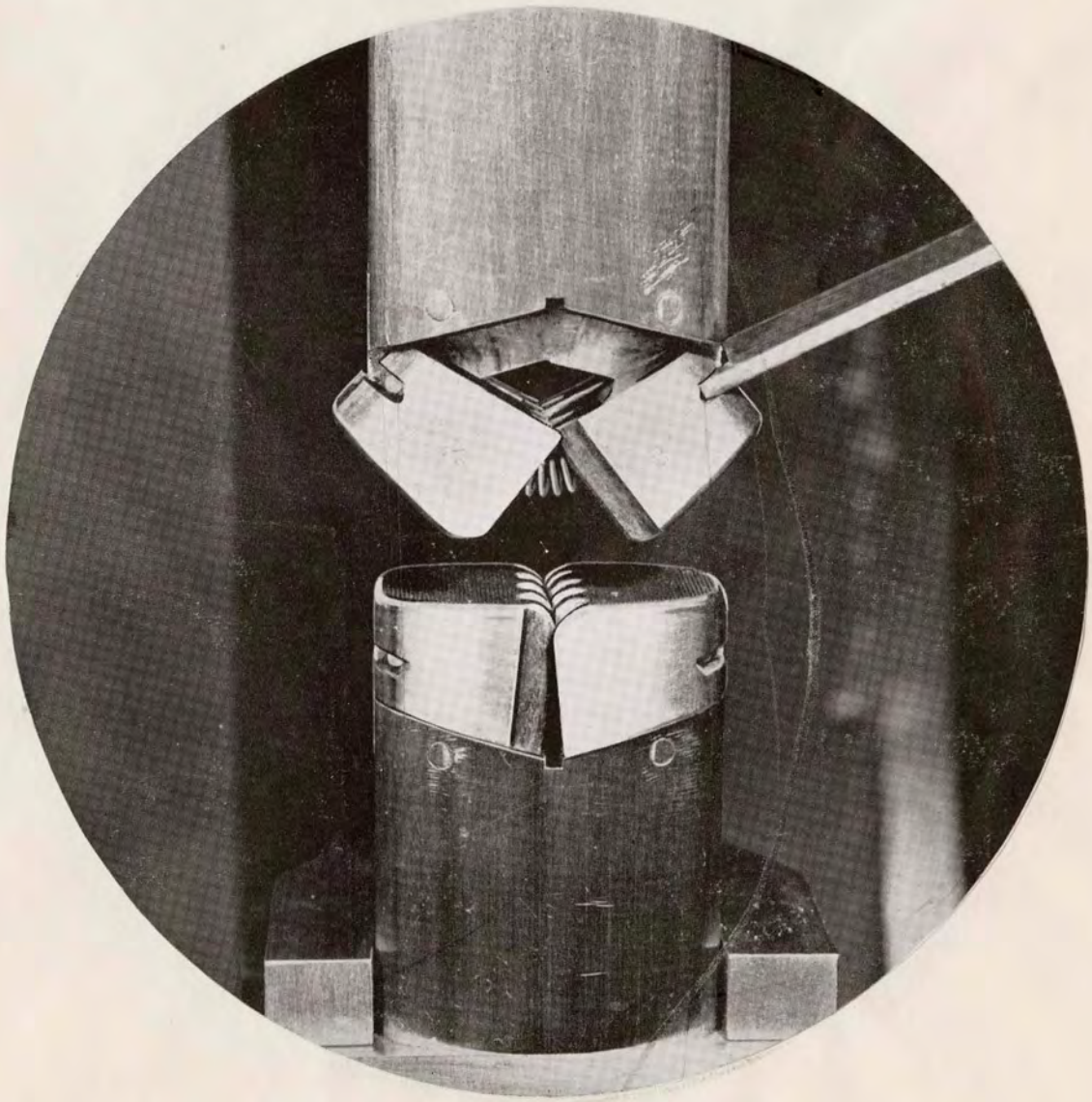


Figure 3

At first glance one might think that the shrinker would leave an irregular surface on the material worked. This is true if one attempts to shrink the work violently or extremely, but under normal operation the only surface change to be found is a loss of polish. The roughness of the working surface of the jaws should be matched with the class of finish desired, however, as much more rapid shrinking is possible with serrated surfaces, which can be used if the resulting marks are not objectionable.

PUNCHING AND RIVETING MACHINE

Only an explanation of the manner in which this machine works will be given. An attempt to explain more fully would get too complicated and technical. The hole is punched through two or more layers of material after they are in an assembled position. The punch remains in the hole it has just punched, keeping the parts in accurate alignment. The river is then fed down onto the punch, pushing the punch out of the hole as the rivet enters. No shifting of the materials is possible, nor is any effort required to locate the rivet in the hole as the two operations arefully automatic and are performed without moving the material or the machine.

SHEET METAL FORMER

The "ERCO" FORMER (Figure 4) is a new type machine which provides a means of forming or flanging the edges of sheet metal where the contour is so irregular that hand work would

SHEET METAL FORMER

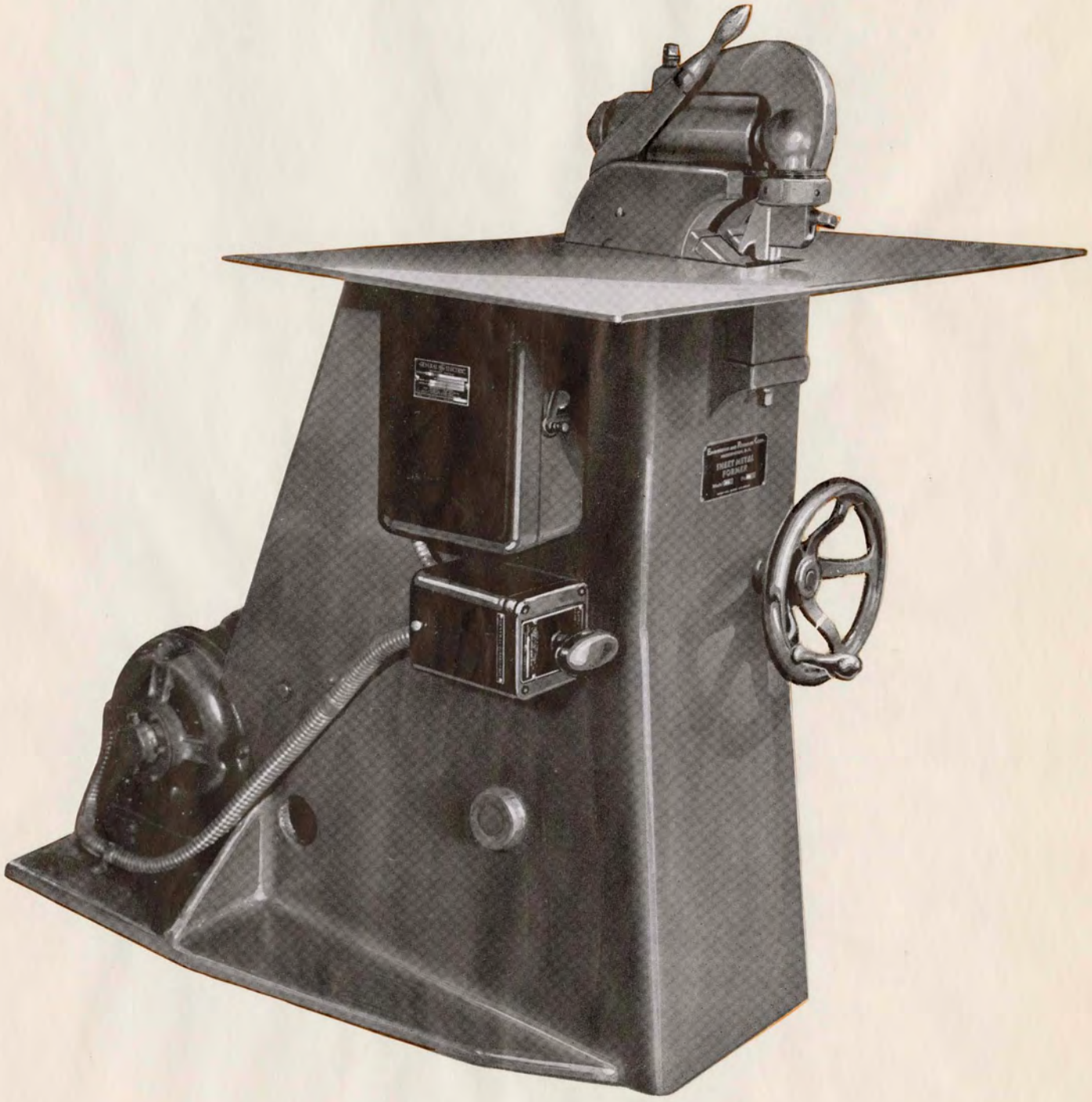


Figure 4

otherwise have to be resorted to.

The method of forming or flanging is through the oscillation of a short brake against a holding-down tool at a speed of 250 and 500 strokes per minute. The total angle of this motion is controlled by a hand wheel in front of the machine.

The working parts consist of an Anvil, a Brake Tool and a Hold-down Tool mounted on a solid frame which encloses the operating mechanism and supports the motor. (Figure 4) Seperate tools are required for each height of flange and thickness of material.

In keeping with the spirit of progress, they intend to carry out a program similiar to that of the Civil Aeronautics Authority. Students, from the University of Maryland, will be trained both on the ground and in the air, to fly their own airplane-ERCOUPE. A comparison will then be made of their results and those of the Civil Aeronautics Authority. These will be used to make improvements in order to lessen solo flight time.

The fact, that many large airplane manufacturing companies buy machinery for producing airplane structures from Engineering Corporation, is enough in itself to show the advancement that has been made in this field over the short span of ten years. Marked progress in propeller production and design has resulted in securing government contracts. Carrying out these contracts, lay down rigid specifications, points out the reliability of this young company.

INFORMATION

All the information for this paper was obtained from an inspection trip of the Engineering Research Corporation's plant at Riverdale, Maryland and a personal interview by Mr. Fred E. Weich, Chief Engineer of the Company.